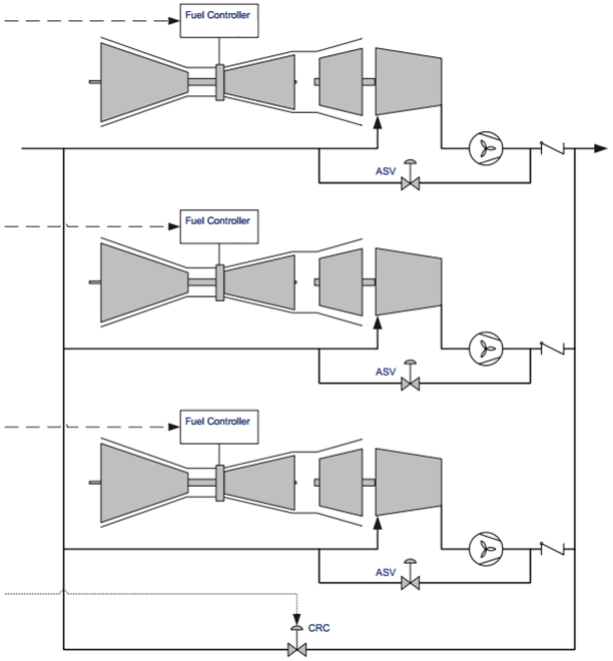
BU PA-IS, A&ES, November 2013

SmartSharing™
Adaptive Load Sharing Controller

Power and productivity
for a better world™

Load Sharing
In Gas Compression Stations

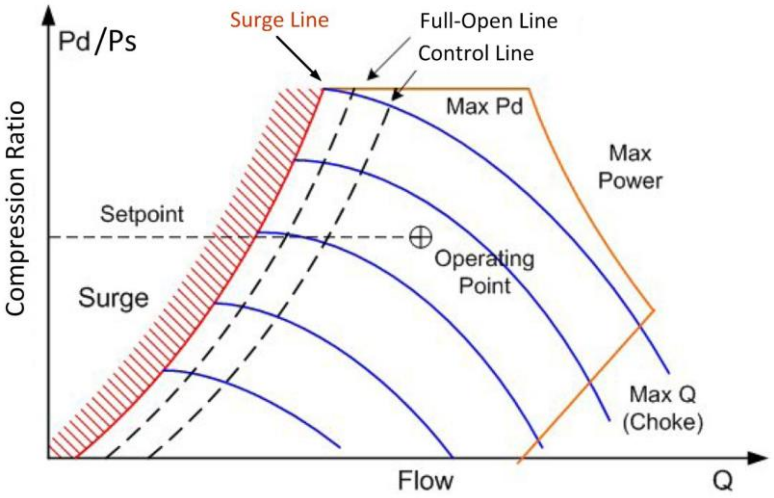
- When one machine is not enough to provide enough flow or pressure, multiple compressors/pumps are used in parallel
- The main goal of Load Sharing Control is to reduce compressors/pumps recycling, however these methods are mostly experience/empirical based and not very efficient on the long term
- *Main Goals:*
  - Reduce machine saturation
    - Less recycle
    - Less time spend in over-speed limit/temperature limit



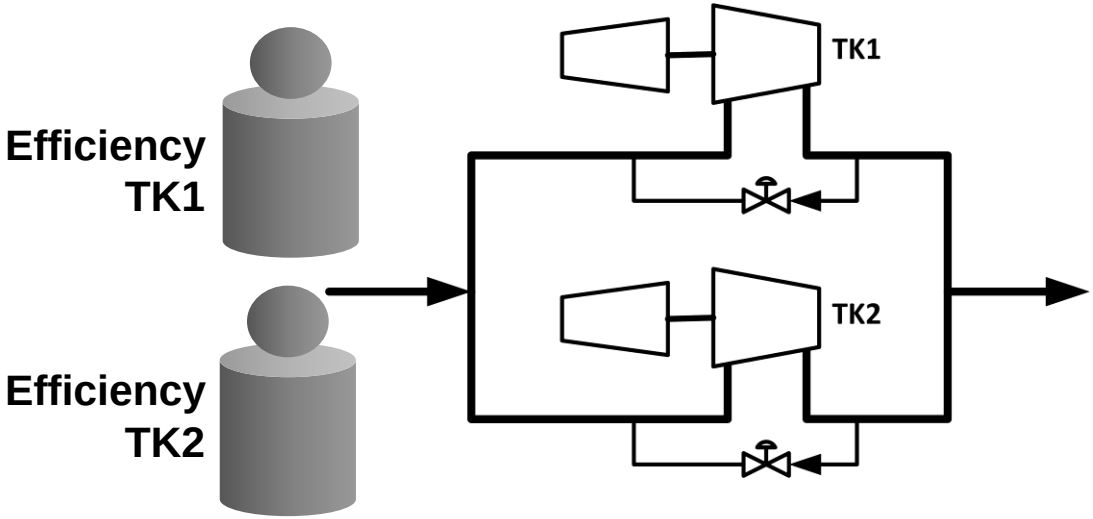
- Improve response time to reference change
- Improve fuel/power efficiency per Sm3 of compressed gas

Load Sharing
Base Concept

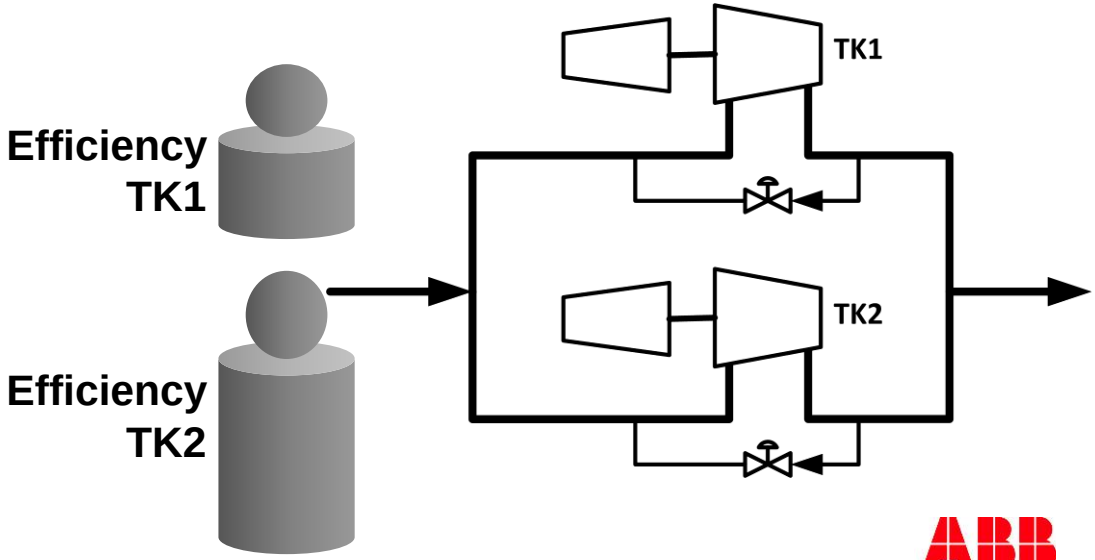
- Load Sharing is a complex problem, that requires information on:
  - “Weights” of machine’s efficiency
  - Operative Limits



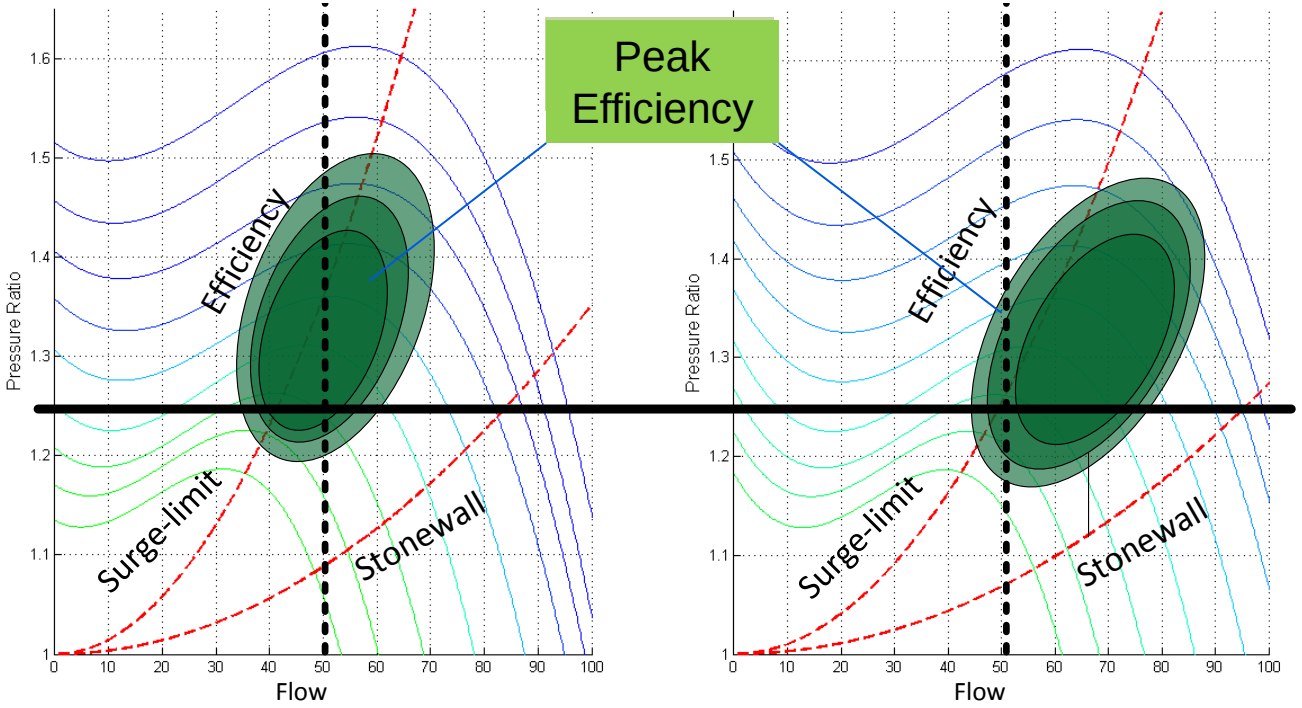
“Ideal Case” - Similar Machines, Similar Efficiency



“Real Case” – Similar Machines, Different Efficiency

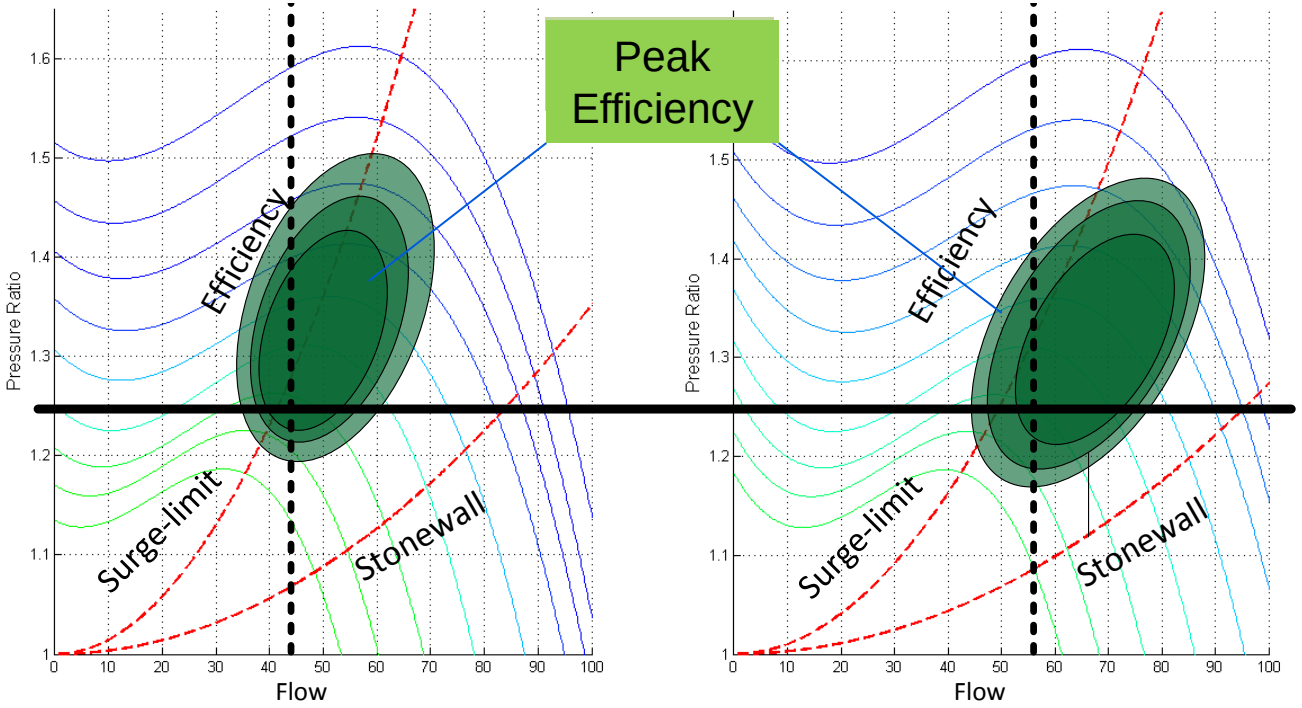


Load Sharing
Equal Sharing



Machine #1 Production 0.5 CMm3/h
Machine #2 Production 0.5 CMm3/h
Fuel Consumption 2000 Cm3/h
Total Production 1.00 CMm3/h

Load Sharing
Performance Based Sharing



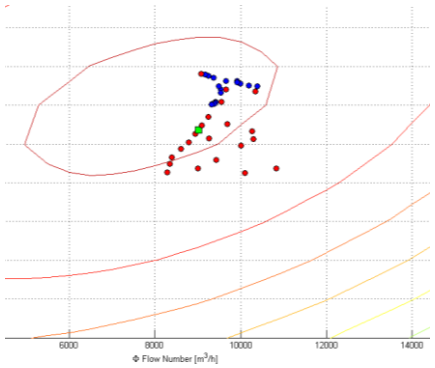
Machine #1 Production 0.45 CMm3/h
Machine #2 Production 0.55 CMm3/h
Fuel Consumption 1900 Cm3/h (-5%)
Total Production 1.00 CMm3/h

Same production
Less consumption

Load Sharing
What is needed

- Nowadays in order to define the efficiency “weights” and the operative limits it is needed:
  - A site survey of an expert of compressors/turbines
  - An extensive data collection
  - Several days for commissioning and testing
- However the efficiency and the operative limits change due to:
  - Different environmental conditions (seasons, day/night)
  - Wear and tear, maintenance activities, aging
  - Changes in the plant or in the pipeline
- Due to these causes, the tuning becomes quickly obsolete and the improvements fade away.
- How to respond to these changes? With *Adaptive Load Sharing*!

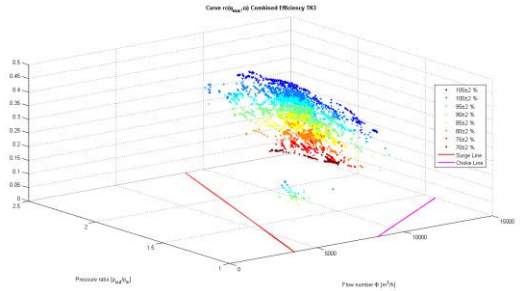
Load Sharing
Patented Technology: Performance Identification



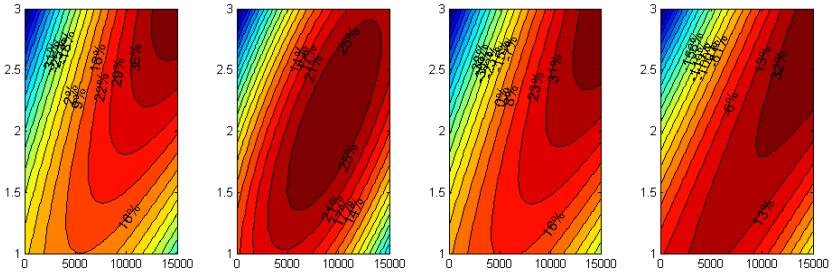
Process Measurements:

(Pressures; Temperatures; Flows; Speeds; ..)

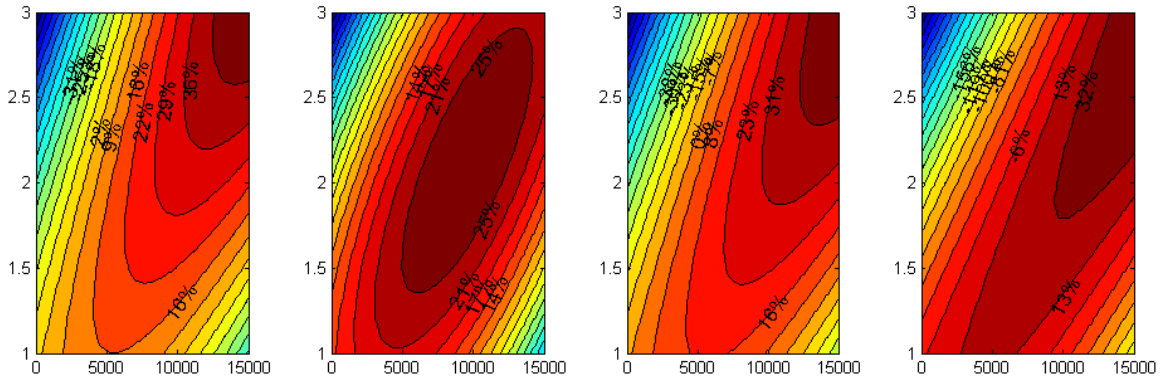
Data Computing



Performance Identification



Load Sharing
Patented Technology: Performance Identification



The technology tracks the performance drift caused by

Slow changes (aging, wear and seasons)

and

Fast changes (day/night, maintenance, washing)

Performance “weights” and operation limits are constantly updated, in order to have always a clear and fresh picture of machine status and performance

Load Sharing
SmartSharing™: Adaptive Load Sharing Controller

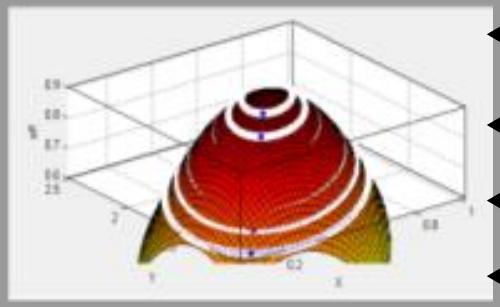
Process Variables

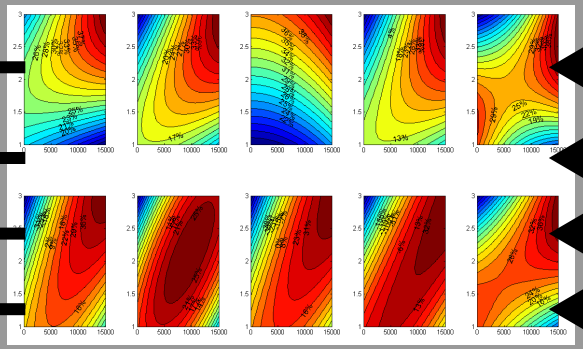
Process Variables

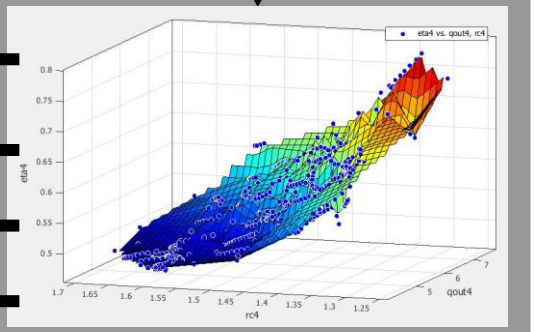
Control Action

Optimal Setpoint

Process repeated for each machine







Optimization according to process limits

SmartSharing™

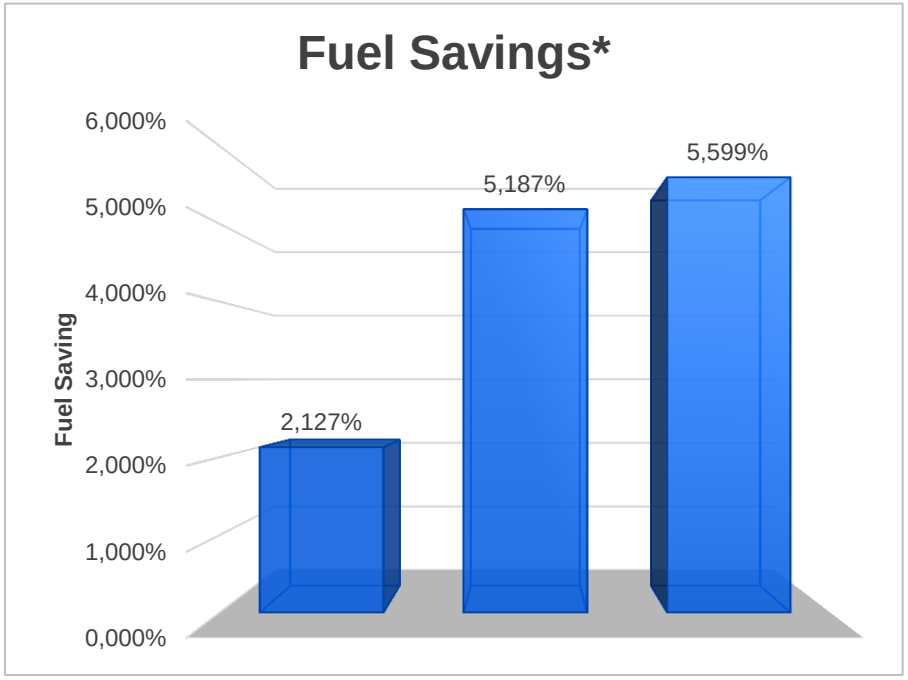
Machine Characteristics Identification

Load Sharing
SmartSharing™

Load Sharing Controller - SmartSharing™

- Stand alone module – base configuration via embedded touchscreen HMI
- Easy integration in ABB and other suppliers DCS
- Communication with DCS by using common industrial interfaces: Modbus, OPC, Profibus, MMS
- Up to 10 machines monitored and optimized per controller
- Several optimization strategies selectable:
  - Maximum compressor efficiency
  - Maximum turbine and compressor efficiency
  - Minimum Fuel consumption
- Remote monitoring via web server (in development), access from PC or mobile devices

SmartSharing™
Potential Improvement



* Savings depending on plant and machine type

Typical Improvement

- Reduction of trips due to over-speed / high temperature
- Less recycle during normal operation

- Fuel savings depends on a case by case basis, however a preliminary study can be performed in order to estimate it before the investment
- Expected saving can vary from 1 to 6% in fuel gas or power consumption

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